

**What is claimed is:**

1. A multi-functional fitness bicycle, comprising front and rear wheels, a saddle, a frame and hand-and-foot drive system; the hand-and-foot drive system includes at least one pedal, and a foot drive chainwheel, the foot drive chainwheel being coupled with the pedal via a pedal crank; the hand-and-foot drive system further comprises a front wheel drive system including a hand drive gear, which is driven by a rocker arm integrated with a front fork; the front driving rocker arm is pivoted to the front driving axle seat and drives the front wheel; characterized in that the bicycle further comprises an inertial energy storage wheel for adjusting resistance automatically and a variable-resistance control system, which automatically adjusts kinetic resistance of the inertial energy storage wheel when the bicycle is driven.
2. The bicycle according to claim 1, characterized in that the variable-resistance control system includes at least one centrifugal fly block arranged along the periphery of the inertial energy storage wheel and a damping belt around the inertial energy storage wheel and the centrifugal fly block; one end of the centrifugal fly block is pivoted to the inertial energy storage wheel, and the other end thereof is elastically supported, the ends of the centrifugal fly block extend to push the damping belt when the speed of the inertial energy storage wheel reaches a predetermined value, increasing resistance between the inertial energy storage wheel and the damping belt.
3. The bicycle according to claim 1, characterized in that the variable-resistance control system includes at least one T-shape fly block arranged along the periphery of the inertial energy storage wheel and a damping belt around the inertial energy storage wheel and the T-shape fly block; the T-shape fly block is placed in a groove formed in the periphery of the inertial energy storage wheel, the lower end of the T-shape fly block being placed in a radial hole of the groove and an elastic member being provided at the bottom thereof; a blocking member for preventing the T-shape fly block from falling off is

arranged along the outer edge of the inertial energy storage wheel.

4. The bicycle according to claim 1, characterized in that the variable-resistance control system includes an eccentric wheel and an elliptical wheel that are coupled with the foot drive chainwheel, and a pull/push rod arranged on the frame, a magnetic damping plate being provided at the bottom of the pull/push rod and a roller being provided at the top thereof, which is in tangent contact with the eccentric wheel and the elliptical wheel; when the distal ends of the eccentric wheel and the elliptical wheel are in contact with the roller, the damping plate produces a maximum resistance to the inertial energy storage wheel.

5. The bicycle according to claim 1, characterized in that the variable-resistance control system further includes an eccentric wheel and an elliptical wheel that are coupled with the foot drive chainwheel, and a damping belt around the inertial energy storage wheel; a pull rod is arranged at the end of the damping belt, the eccentric wheel and the elliptical wheel push the pull rod to move the damping belt, generating a variable resistance to the inertial energy storage wheel.

6. The bicycle according to claim 4 or 5, characterized in that the variable-resistance control system further includes a driven chainwheel coupled with a driving chainwheel on the the foot drive middle axle, and an eccentric wheel coupled with the driven chainwheel; a derailleur is arranged between the driven chainwheel and the eccentric wheel, enabling the eccentric wheel to rotate at the same angular speed as that of the driven chainwheel, or enabling the eccentric wheel to rotate at an angular speed twice of that of the driven chainwheel.

7. The bicycle according to claim 1, characterized in that the variable-resistance control system includes a resistance adjusting wheel coupled with the foot drive chainwheel, and a damping belt around the inertial energy storage wheel having its one end fixed to periphery of the driven wheel via a draw wire; the periphery of the resistance adjusting wheel is arranged with a plurality of

regulating holes at different distances from the center of the circle thereof, the draw wire being fixed to the regulating holes by a locking member.

8. The bicycle according to claim 7, characterized in that the variable-resistance control system further includes a driven chainwheel coupled with a driving chainwheel on the the foot drive middle axle, and a resistance adjusting wheel linked to the driven chainwheel; a derailleur is arranged between the driven chainwheel and the resistance adjusting wheel, the derailleur enabling the resistance adjusting wheel to rotate at the same angular speed as that of the driven chainwheel, or enabling the resistance adjusting wheel to rotate at an angular speed twice of that of the driven chainwheel.

9. The bicycle according to claim 2, 3, 4, 5 or 7, characterized in that the inertial energy storage wheel is arranged at an axle of the rear wheel and is or is not coaxial with the rear wheel, or the inertial energy storage wheel is arranged at the foot drive middle axle with its rotating center coinciding with the axis of the foot drive middle axle.

10. The bicycle according to claim 9, characterized in that the inertial energy storage wheel for adjusting resistance automatically can be applicable to stationary fitness equipment such as a fitness car and the like.

11. The bicycle according to claim 1, characterized in that an elliptical chainwheel and an eccentric chainwheel are arranged on the foot drive middle axle, and the long axis of the elliptical chainwheel and the radial central line of the engaged pedal crank forms an angle of about  $90^{\circ}$ ; and a straight line connecting the geometrical center of the eccentric chainwheel and the center of the foot drive middle axle on the plane of the chainwheel and the radial central line of the engaged pedal crank forms an angle of about  $90^{\circ}$ .

12. The bicycle according to claim 1, characterized in that a pedaling shifting structure is arranged on the foot drive middle axle for shifting between a parallel pedaling and an alternate pedaling, the pedaling shifting structure includes an inner racket sleeve fixed to one side of the foot drive middle axle and an outer racket sleeve fixed to the pedal crank, a notched portion is

arranged on at least one side of the radial outer periphery of the inner ratchet sleeve, the ends of the notched portion are arranged as engaging shoulders, and at least one engaging arm is arranged on the outer ratchet sleeve on the same side; the engaging arm is engaged to the engaging shoulder so as to engage the inner ratchet sleeve with the outer ratchet sleeve to rotate together.

13. The bicycle according to claim 12, characterized in that the notched portion is arranged on each of the symmetrical two sides on the radial outer periphery of the inner ratchet sleeve, the two ends of each of the notched portion are arranged as engaging shoulders, and two engaging arms are arranged correspondingly, the two engaging arms are engaged to the engaging shoulders on the two sides of the notched portion respectively/simultaneously.

14. The bicycle according to claim 12 or 13, characterized in that a engaging push wheel is arranged for engaging with the engaging arms, the engaging push wheel being arranged in the outer ratchet sleeve, the lower side of the engaging push wheel forming an arcuate pushing surface in equal radius, a first pushing surface being formed extending from two sides of the arcuate pushing surface in an upside down “八” shape and enabling the engaging arm to push the engaging shoulder, and a second pushing surface being formed above the first pushing surface and being capable of pushing the engaging arm away from the engaging shoulder.

15. The bicycle according to claim 12, characterized in that an elastic member is arranged on the outer sleeve of the pedaling shifting structure for pushing the engaging arm toward the engaging push wheel.

16. The bicycle according to claim 1, characterized in that a pedaling shifting structure is arranged on the foot drive middle axle of the bicycle for shifting between a parallel pedaling and an alternate pedaling, the pedaling shifting structure includes an inner sleeve fixed to the foot drive middle axle and an outer sleeve fixed to the pedal crank, two notches are arranged symmetrically in the outer sleeve, and correspondingly, a tongue is arranged on the inner sleeve, when the pedal crank and the outer sleeve connected thereto are driven

to rotate, the tongue is engaged to the notches to rotate the inner sleeve, the middle axle, the outer sleeve and the crank synchronously, and fix the left and right pedals in parallel or alternately at 180°.

5           17.     The bicycle according to claim 16, characterized in that out of the two symmetrical notches in the outer sleeve, a plurality of notches are arranged on the two sides of the notch that can fix the left and right pedals in parallel, such that the pedal cranks can be set nearly in parallel by means of these notches.

10           18.     The bicycle according to claim 16, characterized in that a fixing hole is arranged in the pedal crank, which is fixed to the foot drive chainwheel via a bolt and the hole.

15           19.     The bicycle according to claim 1, characterized in that a pedal upper sleeve can rotate around a pedal shaft; and a threaded rod is arranged under the pedal upper sleeve, the threaded rod is screwed into a pedal sleeve at the lower portion of the pedal and adjusts and fixes the distance between the pedal and the pedal upper sleeve by a bolt hole in the pedal sleeve.

20           20.     The bicycle according to claim 19, characterized in that a sleeve extension portion that can be mounted removably is arranged on the pedal upper sleeve, the sleeve extension portion is above the pedal.

25           21.     The bicycle according to claim 20, characterized in that the bicycle further comprises a special shoe including a shoe face and a shoe bottom, the shoe face being provided with a concave engaged with the extension portion of the pedal upper sleeve for limiting the extension portion from moving forward and backward.

30           22.     The bicycle according to claim 21, characterized in that the concave is arranged on an independent block, a releasable fastening structure is arranged at the bottom of the independent block, and a corresponding releasable fastening structure is arranged on the shoe face.

            23.     The bicycle according to claim 22, characterized in that the releasable fastening structure is comprised of press buttons.

35           24.     The bicycle according to claim 23, characterized in that a fixing string is

arranged on the independent block, and at least two fixing hooks are arranged on the shoe face, the independent block is fixed onto the shoe face by pulling the fixing string through the fixing hooks.

25. The bicycle according to claim 19 or 20, characterized in that a groove or a pushing surface is arranged in the threaded rod, holes are arranged in the pedal sleeve, and an engaging member can extend into the groove or pushing surface to prevent the pedal from rotating around the threaded rod.

26. The bicycle according to claim 25, characterized in that the engaging member is an eccentric wheel connected to a handle, the rotating shaft of the eccentric wheel is fixed with the pedal sleeve.

27. The bicycle according to claim 1, characterized in that the pedal comprises a hooking pin pivoted to the pedal shaft, at least one connecting bar is fixed to the two symmetrically arranged pedal blocks at the inner side of the hooking pin, the portion of the hooking pin other than the inner side thereof where the hooking pin connects with the connecting bar does not include any other connecting members and is spaced apart from any other members.

28. The bicycle according to claim 27, characterized in that the pedal can be matched with a shoe bottom, the shoe bottom contains a connecting member having a hooking pin hole engaged with the hooking pin member, the connecting member is pivoted or fixed to the shoe bottom, and a limiting structure for limiting the rotating and swinging angle of the pivoted connecting member.

29. The bicycle according to claim 28, characterized in that the connecting member is arranged in a concave in the shoe bottom, and the height of the connecting member does not exceed beyond the plane of the shoe bottom.

30. The bicycle according to claim 29, characterized in that an elastic member is arranged in the hooking pin hole of the connecting member to enable the hooking pin hole to forcibly hold the hooking pin.

31. The bicycle according to claim 30, characterized in that at least one surface of the hooking pin is aligned with the stepping surface of the two pedal blocks.

32. The bicycle according to claim 1, characterized in that the bicycle further comprises a front damping system, the front damping system is arranged between the front wheel axle and the frame and includes an upper pivot tube and a lower pivot tube, the upper pivot tube is pivoted with the end of the lower pivot tube, a hand drive chainwheel is arranged coaxially on the pivot axle; meanwhile, a spring lever is arranged between the upper pivot tube and the lower pivot tube.
33. The bicycle according to claim 1, characterized in that the frame is provided with at least one fixing hole for adjusting the height of the foot drive middle axle, and a first regulating rod having its lower end hinged to the foot drive middle axle seat, a plurality of first regulating holes matched with the fixing hole are arranged on the first regulating rod for fixing and adjusting the height of the foot drive middle axle seat.
34. The bicycle according to claim 33, characterized in that the foot drive middle axle seat is further coupled with a second regulating rod having its one end fixed to the foot drive middle axle seat and the other end pivoted to the front or rear end of the frame.
35. The bicycle according to claim 34, characterized in that two first regulating rods may be hinged to the foot drive middle axle seat, a plurality of first regulating holes are arranged in the other end of each first regulating rod, and a plurality of fixing holes are arranged in the frame, the first regulating holes are fixed respectively to the fixing holes for fixing and adjusting the height of the foot drive middle axle seat.
36. The bicycle according to claim 1, characterized in that a first engaging tube is arranged under the frame central upright tube, a second engaging tube is arranged on the foot drive middle axle seat, which can be inserted into the first engaging tube and can move upward and downward to be locked at different heights of the first engaging tube.
37. The bicycle according to claim 1, characterized in that a hand drive rocker arm provided with a hand drive chainwheel is pivoted to the front driving axle

seat on the front fork, and front and rear brake devices are arranged on the front drive axle seat, the brake handles thereof exceed beyond the hand drive chainwheel for the convenience of being held.

38. The bicycle according to claim 37, characterized in that the front drive axle seat is coupled with the upper end of the front fork via a regulating mechanism, the regulating mechanism includes an inner sleeve and an outer sleeve, regulating holes are arranged in the outer sleeve, and a locking groove is arranged in the inner sleeve, the engaged depth of the inner sleeve and outer sleeve is adjusted and fixed by a bolt.

39. The bicycle according to claim 38, characterized in that the front drive axle seat is fixed to the outer sleeve, the inner sleeve is positioned above the front fork and is screwed into the outer sleeve.

40. The bicycle according to claim 39, characterized in that a slide-proof groove and a slide-proof plate are arranged on the inner sleeve, the slide-proof plate has its one end pivoted to the outer sleeve and the other end formed with fixing holes and can be fixed to the outer sleeve, the edge of the slide-proof plate passes through an opening on the outer sleeve, the slide-proof plate can be imbedded into the slide-proof groove to avoid relative slide between the front drive axle seat and the front fork; a small hole for assembly and disassembly is formed adjacent to the outer side of the slide-proof plate.

41. The bicycle according to claim 37, characterized in that a variable-speed control device is arranged in front of the front drive axle seat, the variable-speed control device comprises a first control handle for shifting positions by hooking with fingers and a second control handle for shifting positions by pushing with fingers' back, the length and shape of the first and second control handles shall be configured such that they can move around the front drive chainwheel for the convenience of hooking and pushing with fingers, the whole variable-speed control device is integrated with the brake handles.

42. The bicycle according to claim 37, characterized in that the front and rear



brake device further comprises brake handles arranged on the drive handle on the front drive rocker arm, one end of the brake handle is fixed to the drive handle, and its central portion can be pressed on the driving disc coaxially coupled with the shaft of the drive handle, a first reset elastic member is arranged on the side of the driving disc, a draw wire is connected to a driven disc in the middle of the hand drive rocker arms, a second reset elastic member is arranged on the side of the driven disc, the driven disc is displaced via the draw wire; the middle of a forcipate brake arm is pivoted to the front drive axle seat, the forcipate brake arm is comprised of an outer push arm and an inner pull arm, the outer push arm and the inner pull arm are arranged across the driven disc, the periphery of the driven disc may contact with the outer push arm of the forcipate brake arm, the inner pull arm is brought to rotate by pushing the outer push arm so as to move the brake wire connected with the inner pull arm.

43. The bicycle according to claim 42, characterized in that a linkage brake device is arranged on the front drive axle seat, a protrusion is arranged on the brake handle of the linkage brake device, the protrusion can be pressed on the inner pull arm of the forcipate brake arm to rotate the forcipate brake arm.

44. The bicycle according to claim 1, characterized in that the shafts of the hand drive handles can be coupled with the front drive rocker arms via adjustable tubes fixed thereto, the adjustable tubes can be shifted between two angular positions differing 180° along the circumferential direction and are fastened to the ends of the front drive rocker arms, and allows the shafts of the hand drive handles to be in parallel, a locking hole and a locking member may be arranged on the adjustable tube.

45. The bicycle according to claim 44, characterized in that two rows of longitudinally distributed locking holes are formed symmetrically at 180° on the adjustable tube, each of the locking holes can be engaged with the clip pin on the hand drive rocker arm, a push elastic member is arranged inside the clip pin, at least two locking holes that are symmetrically distributed at 180°

may be arranged on the adjustable tube.

46. The bicycle according to claim 1, characterized in that the front wheel driving system further comprises an axle transmission structure including a transmission axle arranged inside the sleeve between the hand drive gear and the front wheel axle, the two ends of the transmission axle are provided with a first and a second conical gears, the first conical gear is engaged with a third conical gear arranged on the hand drive rocker arm axle, the third conical gear can integrated with the hand drive gear, the second conical gear is engaged with a fourth conical gear on the front wheel axle, the transmission axle may includes an upper axle tube and a lower axle tube that are axially engaged by insertation and can only move relatively along the axial direction.

47. The bicycle according to claim 46, characterized in that the third conical gear, the first conical gear and the upper axle tube of the transmission axle can be pivoted respectively to the fixing seat of the front drive axle and an adjusting and connecting sleeve fixed to the fixing seat of the front drive axle, the fixing seat of the front drive axle and the adjusting and connecting sleeve can bring the first and third conical gears and the upper axle tube of the transmission axle to move up and down within a certain height, the adjusting and connecting sleeve can be locked to positions at different heights above the sleeve between the hand drive gear and the front wheel axle.

48. The bicycle according to claim 46, characterized in that the axle transmission structure for the front wheel drive can be arranged independently on the side of the existing front wheel damping system.

49. The bicycle according to claim 46, characterized in that the axle transmission structure and the damping structure can be arranged as a combined structure, the combined structure is configured such that the transmission axle also includes an upper axle tube and a lower axle tube, the upper axle tube and the lower axle tube are engaged axially by insertation and can only move relatively along the axial direction, the sleeve between the hand drive rocker arm axle and the front wheel axle includes an upper outer sleeve and a lower

outer sleeve, the upper axle tube of the transmission axle is pivoted to the upper outer sleeve between the hand drive rocker arm axle and the front wheel axle, the lower axle tube of the transmission axle is pivoted to the lower outer sleeve between the hand drive rocker arm axle and the front wheel axle, and an elastic member like a damping spring is arranged within each of the upper axle tube and the lower axle tube of the transmission axle and the upper outer sleeve and the lower outer sleeve between the hand drive rocker arm axle and the front wheel axle.

50. The bicycle according to claim 49, characterized in that a piston is arranged under the upper axle tube of the transmission axle, and a piston tube or a hydraulic cylinder is arranged in the lower axle tube of the transmission axle.

51. The bicycle according to claim 49, characterized in that the combined structure may be configured such that the damping structure is merely arranged in the sleeve on one side, and an axle transmission structure is arranged in the sleeve on the other side instead of the damping structure.

52. The bicycle according to claim 1, characterized in that the bicycle is placed on a stationary frame, the frame comprises a bottom frame, a transmission member linking the front and rear wheels, a rear wheel support portion for supporting and fixing the rear wheel axle of the bicycle, and at least a first and a second transmission wheels that contact respectively with the front and rear wheels, the pivots of the first and second transmission wheels are fixed to the bottom frame and are coupled with the transmission member.

53. The bicycle according to claim 52, characterized in that the distance between the first and second transmission wheels can be adjusted, the adjusting structure includes a front and a rear sleeves that are engaged by insertation, and securing members on the sleeves for fixing the front and rear sleeves.

54. The bicycle according to claim 1, characterized in that the bicycle may be placed on a stationary frame, the frame comprises a bottom board, a transmission structure moving around the bottom board, a front wheel limiting bracket for limiting the rotating and swinging of the front wheel of

the bicycle, and a rear wheel support bracket for fixing the rear wheel axle of the bicycle, the transmission structure is contacted with and linked to the front and rear wheels.

55. The bicycle according to claim 54, characterized in that the front wheel limiting bracket and the rear wheel support bracket can be conveniently folded and removed, the transmission structure moving around the bottom board can be a transmission belt that allows the exerciser to run on it, the stationary frame further comprises handrails for doing running exercises.

56. The bicycle according to claim 1, characterized in that a flywheel installation section having a little diameter is arranged on the extension of the front wheel hub, a front wheel flywheel with small amount of teeth is fixed onto the flywheel installation section, a concave is formed on the front wheel flywheel in its axial cross-section, the teeth of the flywheel are arranged in the concave, a engaging structure and slide accessories of the flywheel are arranged on the side of the concave.

57. The bicycle according to claim 56, characterized in that the inner sleeve of the flywheel is integrated with the front wheel hub.

58. The bicycle according to claim 1, characterized in that the saddle comprises a frame inside and a soft material on its surface, the rear main part of the frame is higher than the front protruded part of the frame.

59. The bicycle according to claim 1, characterized in that the saddle comprises a frame inside and a soft material on its surface, the frame of the saddle is divided into two parts that are pivoted via a pivot.